AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application:

1. (Currently amended) An apparatus for decoding a Reed-Muller code in which information data is encoded by using mask symbols and orthogonal codes, the information data including a first portion and a second portion, the apparatus comprising:

an arithmetic operation unit ~~configured~~ to calculate ~~a first~~ an exclusive OR of [[the]] a first Reed-Muller code and each of a plurality of mask patterns to obtain a first exclusive OR output, each of the mask patterns representing an exclusive ORed value of ~~a candidate pattern of~~ the mask symbols and the first portion of the information data ~~corresponding to the candidate pattern~~;

a first decoder ~~configured to calculate~~ to decode a part of the second portion of the information data that corresponds to the orthogonal codes by calculating a checksum of the first exclusive OR output to obtain a plurality of checksum outputs and ~~majority-decide~~ deciding by majority a value of each of the checksum outputs ~~to decode a part of the second portion of the information data corresponding to the orthogonal codes~~;

a second decoder ~~configured to calculate~~ to decode a remaining part of the second portion of the information data by calculating a second exclusive OR of the first exclusive OR output and a product of the part of the second portion of the information data and the orthogonal codes to obtain a second exclusive OR output, and ~~majority-~~

~~decide~~ deciding by majority a value of the second exclusive OR output ~~to decode a remaining part of the second portion of the information data corresponding to the orthogonal codes~~;

a Reed-Muller encoder ~~configured~~ to ~~Reed-Muller~~ encode the decoded second portion of the information data ~~output from the first decoder and the second decoder~~ and the first portion of the information data into a plurality of second Reed-Muller codes corresponding to the mask patterns, the decoded second portion including the decoded part and the decoded remaining part output from the first decoder and the second decoder;

a Euclidean distance calculator to calculate a Euclidean distance between the first Reed-Muller code and each of the second Reed-Muller codes to obtain a plurality of Euclidean distances; and

a minimum distance detector ~~configured~~ to detect [[the]] a minimum Euclidean distance ~~of a~~ among the Euclidean distances to decode the information data using one of the mask patterns that corresponds to the minimum Euclidean distance. ~~between an output from the Reed-Muller encoder and the Reed-Muller code supplied to the arithmetic operation unit while a plurality of candidate patterns of the mask symbols are supplied to the arithmetic operation unit~~,

~~whereby the first portion of the information data is decoded based on the mask symbols corresponding to the minimum of the Euclidean distance~~.

2. (Currently amended) The apparatus according to claim 1, further comprising a memory ~~configured~~ to store a plurality of exclusive ORed values ~~of a plurality of~~

~~candidate patterns of the mask symbols and a plurality of information data corresponding to the candidate patterns~~ corresponding to the mask patterns, and wherein the arithmetic operation unit calculates the ~~first~~ exclusive OR of the first Reed-Muller code[[s]] and each of the plurality of exclusive ORed values stored in the memory.

3. (Currently amened) The apparatus according to claim 1, further comprising a hard decision unit ~~configured~~ to hard-decide the first Reed-Muller code supplied to the arithmetic operation unit.

4. (Currently amended) The apparatus according to claim 1, wherein the first decoder comprises:

a memory ~~configured~~ to store the first exclusive OR output from the arithmetic operation unit;

a checksum calculator ~~configured~~ to read bit data from the memory and calculate a plurality of exclusive ORs of a plurality of sets of the read bit data to obtain ~~a plurality of~~ the checksum[[s]] outputs;

a selector ~~configured~~ to select some of the plurality of checksum[[s]] outputs based on a type of the Reed-Muller code;

an accumulator ~~configured~~ to accumulate the selected checksums; and

a hard decision unit ~~configured~~ to hard-decide an output from the accumulator.

5. (Currently amended) A method of decoding a Reed-Muller code in which information data is encoded by using mask symbols and orthogonal codes, the information data including a first portion and a second portion, the method comprising:

calculating ~~a first~~ an exclusive OR of [[the]] a first Reed-Muller code and each of a plurality of mask patterns to obtain a first exclusive OR output, each of the mask patterns representing an exclusive ORed value of ~~a candidate pattern of~~ the mask symbols and the first portion of the information data ~~corresponding to the candidate pattern~~;

calculating a checksum of the first exclusive OR output to obtain a plurality of checksum outputs; [[and]]

~~majority judging~~ deciding by majority a value of each of the checksum outputs to decode a part of the second portion of the information data corresponding to the orthogonal codes;

calculating a second exclusive OR of the first exclusive OR output and a product of the part of the second portion of the information data and the orthogonal codes to obtain a second exclusive OR output; [[and]]

~~majority judging~~ deciding by majority a value of the second exclusive OR output to decode a remaining part of the second portion of the information data ~~corresponding to the orthogonal codes~~;

~~Reed-Muller~~ encoding the decoded second portion of the information data and the first portion of the information data into a second Reed-Muller code, the decoded second portion including the decoded part and the decoded remaining part; [[and]]

calculating a Euclidean distance between the first Reed-Muller code and each of the second Reed-Muller codes to obtain a plurality of Euclidean distances; and

detecting [[the]] a minimum ~~of a~~ Euclidean distance ~~between the Reed-Muller encoded data and an input Reed-Muller code while a plurality of first exclusive ORs are calculated, whereby the first portion of the information data is decoded based on the mask symbols corresponding to the minimum of the Euclidean distance~~ among Euclidean distances to decode the information data using one of the mask patterns that corresponds to the minimum Euclidean distance.

6. (Currently amended) An apparatus for decoding Reed-Muller code in which information data is encoded by using mask symbols and orthogonal codes, the information data including a first portion and a second portion, the apparatus comprising:

a first arithmetic operation unit ~~configured~~ to calculate an exclusive OR of the Reed-Muller code and each of a plurality of mask patterns to obtain an exclusive OR output, each of the mask patterns representing an exclusive ORed value of ~~a candidate pattern of~~ the mask symbols and the first portion of the information data ~~corresponding to the candidate pattern~~;

a decoder ~~configured~~ to decode the second portion of the information data which corresponds to the orthogonal codes ~~calculate~~ by calculating a checksum of the exclusive OR output to obtain a plurality of checksum outputs and ~~majority decide~~ deciding by majority a value of each of the checksum outputs ~~to decode a part of the second portion of the information data corresponding to the orthogonal codes~~;

a second arithmetic operation unit ~~configured~~ to calculate a first accumulation result of ~~each bit~~ bits of a product of an output from the decoder and the orthogonal codes and a second accumulation result of [[each]] inverted bits of a product of the output from the decoder and the orthogonal codes and detect one of the first accumulation result and the second accumulation result which corresponds to a smaller Euclidean distance between the Reed-Muller code input to the first arithmetic operation unit and encoded data of decoded data of the decoder;

a minimum detector ~~configured~~ to detect the minimum of an output from the second arithmetic operation unit while ~~a plurality of candidate patterns of the mask symbols~~ the mask patterns are supplied to the first arithmetic operation unit[[,]]; and

~~whereby~~ a decoder to decode the first portion of the information data ~~is decoded~~ based on the mask ~~symbols~~ pattern corresponding to the minimum of the output from the second arithmetic operation unit.

7. (Currently amended) The apparatus according to claim 6, further comprising a memory ~~configured~~ to store a plurality of exclusive ORed values of ~~a plurality of candidate patterns of the mask symbols~~ the mask patterns and ~~a plurality of~~ the information data corresponding to the ~~candidate~~ mask patterns, and wherein the first arithmetic operation unit calculates the exclusive OR of the Reed-Muller code[[s]] and each of the plurality of exclusive ORed values stored in the memory.

8. (Currently Amended) The apparatus according to claim 6, further comprising a hard decision unit ~~configured~~ to hard-decide the Reed-Muller code supplied to the first arithmetic operation unit.

9. (Currently amended) The apparatus according to claim 6, wherein the decoder comprises:

a memory ~~configured~~ to store the exclusive OR output from the first arithmetic operation unit;

a checksum calculator ~~configured~~ to read bit data from the memory and calculate a plurality of exclusive ORs of a plurality of sets of the read bit data to obtain ~~a plurality of checksums~~ the checksum outputs;

a selector ~~configured~~ to select some of the ~~plurality of~~ checksum[[s]] outputs based on a type of the Reed-Muller code;

an accumulator ~~configured~~ to accumulate the selected checksum[[s]] outputs; and

a hard decision unit ~~configured~~ to hard-decide an output from the accumulator.

10. (Currently amended) A method of decoding a Reed-Muller code in which information data is encoded by using mask symbols and orthogonal codes, the information data including a first portion and a second portion, the method comprising:

calculating an exclusive OR of the Reed-Muller code and each of a plurality of mask patterns to obtain a first Reed-Muller code, each of the mask patterns

representing an exclusive ORed value of ~~a candidate pattern of~~ the mask symbols and the first portion of the information data ~~corresponding to the candidate pattern~~;

calculating a checksum of the exclusive OR to obtain a plurality of checksum outputs; [[and]]

~~majority decide~~ deciding by majority a value of each of the checksums to decode a part of the second portion of the information data corresponding to the orthogonal codes;

calculating a first accumulation result of ~~each bit~~ bits of a product of decoded data and the orthogonal codes and a second accumulation result of [[each]] inverted bits of a product of the decoded data and the orthogonal codes; [[and]]

detecting one of the first accumulation result and the second accumulation result which corresponds to a smaller Euclidean distance between the ~~input~~ Reed-Muller code and encoded data of the decoded data;

detecting the minimum of one of the first accumulation result and the second accumulation result which has a smaller Euclidean distance between the ~~input~~ Reed-Muller code and encoded data of the decoded data while calculating the exclusive OR of the Reed-Muller code and an exclusive ORed value of each of ~~a plurality of candidate~~ the mask patterns ~~of the mask symbols~~ and the information data ~~corresponding to the candidate pattern~~,

~~whereby~~ decoding the first portion of the information data ~~is decoded~~ based on the mask ~~symbols~~ pattern corresponding to the minimum of one of the first accumulation result and the second accumulation result which has a smaller Euclidean distance between the ~~input~~ Reed-Muller code and encoded data of the decoded data.

11. (Currently amended) An apparatus for decoding a Reed-Muller code in which information data is encoded by using mask symbols and orthogonal codes, the information data including a first portion and a second portion, the apparatus comprising:

an arithmetic operation unit ~~configured~~ to calculate a first product of [[the]] a first Reed-Muller code and each of a plurality of mask patterns to obtain a first exclusive OR output, each of the mask patterns representing an exclusive ORed value of ~~a candidate pattern of~~ the mask symbols and the first portion of the information data ~~corresponding to the candidate pattern~~;

a first decoder ~~configured~~ to decode a part of the second portion of the information data corresponding to the orthogonal codes ~~calculate~~ by calculating a checksum of the first product to obtain a plurality of checksum outputs and ~~majority-decide~~ deciding by majority each of the checksum outputs ~~to decode a part of the second portion of the information data corresponding to the orthogonal codes~~;

a second decoder ~~configured to calculate~~ to decode a remaining part of the second portion of the information data corresponding to the orthogonal codes by calculating a second product of the first product and a product of the part of the second portion of the information data and the orthogonal codes and ~~majority-decides~~ deciding by majority the second product ~~to decode a remaining part of the second portion of the information data corresponding to the orthogonal codes~~;

a Reed-Muller encoder ~~configured~~ to ~~Reed-Muller~~ encode the second portion of the information data output from the first decoder and the second decoder and the first portion of the information data into a Reed-Muller code;

a maximum correlation detector ~~configured~~ to detect the maximum of a correlation between an output from the first Reed-Muller encoder and the second Reed-Muller code ~~supplied to the arithmetic operation unit~~ while ~~a plurality of candidate patterns of the mask symbols~~ the mask patterns are supplied to the arithmetic operation unit[[,]];

~~whereby~~ a decoder to decode the first portion of the information data ~~is decoded~~ based on the mask ~~symbols~~ pattern corresponding to the maximum of the correlation.

12. (Currently amended) The apparatus according to claim 11, further comprising a memory ~~configured~~ to store a plurality of exclusive ORed values of ~~a plurality of candidate patterns of the mask symbols~~ the mask patterns and ~~a plurality of~~ the information data corresponding to the ~~candidate~~ mask patterns, and wherein the arithmetic operation unit calculates the first product of the first Reed-Muller code and each of the plurality of exclusive ORed values stored in the memory.

13. (Currently amended) The apparatus according to claim 11, wherein the first decoder comprises:

a memory ~~configured~~ to store the first product;

a checksum calculator ~~configured~~ to read bit data from the memory and calculate a plurality of exclusive ORs of a plurality of sets of the read bit data to obtain [[a]] the plurality of checksum[[s]] outputs;

a selector ~~configured~~ to select some of the plurality of checksum[[s]] outputs based on a type of the Reed-Muller code; and

an accumulator ~~configured~~ to accumulate the selected checksum[[s]] outputs.

14. (Currently amended) A method of decoding Reed-Muller code in which information data is encoded by using mask symbols and orthogonal codes, the information data including a first portion and a second portion, the method comprising:

calculating a first product of the Reed-Muller code and each of a plurality of mask patterns, each of the mask patterns representing an exclusive ORed value of ~~a candidate pattern of~~ the mask symbols and the information data ~~corresponding to the candidate pattern~~;

calculating a checksum of the first product to obtain a plurality of checksum outputs; ~~and majority-decide~~

deciding by majority a value of each of the checksum outputs to decode a part of the second portion of the information data corresponding to the orthogonal codes;

calculating a second product of the first product and a product of the part of the second portion of the information data and the orthogonal codes; ~~and majority-decides~~

deciding by majority the second product to decode a remaining part of the second portion of the information data corresponding to the orthogonal codes;

~~Reed-Muller~~ encoding the second portion of the information data and the first portion of the information data into a second Reed-Muller code; and

detecting the maximum of a correlation between the first Reed-Muller ~~encoded data~~ code and ~~an input~~ the second Reed-Muller code while a plurality of first products are calculated, whereby the first portion of the information data is decoded based on the mask ~~symbols~~ pattern corresponding to the maximum of the correlation.

15. (Currently amended) An apparatus for decoding Reed-Muller code in which information data is encoded by using mask symbols and orthogonal codes, the information data including a first portion and a second portion, the apparatus comprising:

a first arithmetic operation unit ~~configured~~ to calculate a first product of the Reed-Muller code and each of a plurality of mask patterns, each of the mask patterns representing an exclusive ORed value of ~~a candidate pattern of~~ the mask symbols and the information data ~~corresponding to the candidate pattern~~;

a decoder ~~configured to calculate~~ to decode a part of the second portion of the information data corresponding to the orthogonal codes by calculating a checksum of the first product and ~~majority-decide~~ deciding by majority the checksum ~~to decode a part of the second portion of the information data corresponding to the orthogonal codes~~;

a second arithmetic operation unit ~~configured~~ to calculate a first accumulation result of ~~each bit~~ bits of a product of an output from the decoder and the orthogonal codes and a second accumulation result of [[each]] inverted bits of a product of the

output from the decoder and the orthogonal codes and detect a larger one of the first accumulation result and the second accumulation result;

a maximum detector ~~configured~~ to detect the maximum of an output from the second arithmetic operation unit while ~~a plurality of candidate patterns of the mask symbols~~ the mask patterns are supplied to the first arithmetic operation unit[[,]];

~~whereby~~ a decoder to decode the first portion of the information data ~~is decoded~~ based on the mask ~~symbols~~ pattern corresponding to the maximum of the output from the second arithmetic operation unit.

16. (Currently amended) The apparatus according to claim 15, further comprising a memory ~~configured~~ to store a plurality of exclusive ORed values of ~~a plurality of candidate patterns of the mask symbols~~ the mask patterns and ~~a plurality of~~ the information data corresponding to the ~~candidate~~ mask patterns, and wherein the first arithmetic operation unit calculates the first product of the first Reed-Muller code and each of the plurality of exclusive ORed values stored in the memory.

17. (Currently amended) The apparatus according to claim 15, wherein the decoder comprises:

a memory ~~configured~~ to store the first product;

a checksum calculator ~~configured~~ to read bit data from the memory and calculate a plurality of exclusive ORs of a plurality of sets of the read bit data to obtain a plurality of checksums;

a selector ~~configured~~ to select some of the plurality of checksums based on a type of the Reed-Muller code; and

an accumulator ~~configured~~ to accumulate the selected checksums.

18. (Currently amended) A method of decoding Reed-Muller code in which information data is encoded by using mask symbols and orthogonal codes, the information data including a first portion and a second portion, the method comprising:

calculating a first product of the Reed-Muller code and each of a plurality of mask patterns, each of the mask patterns representing an exclusive ORed value of ~~a candidate pattern of~~ the mask symbols and the information data ~~corresponding to the candidate pattern~~;

calculating a checksum of the first product; ~~and majority-decide~~

deciding by majority the checksum to decode a part of the second portion of the information data corresponding to the orthogonal codes;

calculating a first accumulation result of ~~each bit~~ bits of a product of decoded data and the orthogonal codes and a second accumulation result of ~~each~~ inverted bits of a product of the decoded data and the orthogonal codes; ~~and detect~~

detecting a larger one of the first accumulation result and the second accumulation result;

detecting the maximum of the first accumulation result and the second accumulation result while calculating the first product of the Reed-Muller code and an exclusive ORed value of each of ~~a plurality of candidate~~ the mask patterns ~~of the mask symbols~~ and the information data ~~corresponding to the candidate pattern,~~; and

~~whereby~~ decoding the first portion of the information data ~~is decoded~~ based on the mask ~~symbols~~ pattern corresponding to the maximum of the first accumulation result and the second accumulation result.